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10/529,152

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EXAMINER

OLSEN, ALLAN W

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

11/15/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/529,152

Applicant(s)

KIMURA, YASUKI

Examiner

Allan Olsen

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1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 25 August 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 21-25, 27-36 and 38-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21-25, 27-36 and 38-45 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 May 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

#### ***Claim Rejections - 35 USC § 112***

Claim 42 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 42 recites "... a pattern of which a design size is 0.4  $\mu\text{m}$  or more and 2.0 $\mu\text{m}$  or less...". Is this intended to mean that the design size is between 0.4  $\mu\text{m}$  and 2.0  $\mu\text{m}$ ?

#### ***Claim Rejections - 35 USC § 102***

**Claims 21, 22, 31, 32, 36, 38-40, 42 and 43 are rejected under 35 U.S.C. 102(b) as being anticipated by Kwon et al. in Loading Effect Parameters at Dry Etcher System and Their Analysis at Mask-to-Mask Loading and Within-Mask Loading, SPIE Vol. 4562 pp. 79-87 (hereinafter, Kwon).**

Kwon teaches etching a Cr-based, thin-film photomask. Kwon teaches using an ICP and an etchant comprising  $\text{Cl}_2$ ,  $\text{O}_2$  and He (page 81, line 2). Kwon teaches etching Cr, in the presence of a polymeric organic photoresist (page 80, last line). Kwon teaches etching over a wide range of photoresist/chromium loadings that encompass photoresist coverages that are above and below 70% of the Cr film (see figures 1 and 5). Kwon teaches a Cr: photoresist etch selectivity of less than 1.5 (see figure 3). Kwon

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teaches etching Cr while using parameters such as the power of the plasma source, flow rates and pressure, that match those used by applicant. As such, Kwon is considered to etch at a power level below that which causes a jump in plasma density. Furthermore, Kwon teaches applying a bias power thereby causing at least a part of the chemical species to be supplied in the direction perpendicular to the thin film. Regarding the limitation in claims 21, 31 and 43 that requires etching the thin film in presence of an organic substance other than that derived from the resist layer, the examiner notes that the resist layer itself satisfies this limitation as it is not an organic substance that is *derived* from the resist layer. Figure 1 of Kwon shows the formation of a mask pattern with a design size of 0.8  $\mu\text{m}$  and figure 6 shows CD deviation of 15nm or less.

### ***Claim Rejections - 35 USC § 103***

**Claims 23-25, 27, 28, 30, 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon, as applied above to claims 28 and 39, in view of Oh et al. in Proc. SPIE Vol. 4186, pp. 532-539, Dry Etching Technology of Cr and MoSi Layers Using High-Density Plasma Source (hereinafter, Oh).**

Kwon does not teach biasing the substrate by applying a high frequency power.

Oh teaches additional details regarding the apparatus that is used by Kwon (see line 1 on page 81 of Kwon and Kwon's reference 5). Oh teaches that the DC bias that is disclosed by Kwon is controlled by the power level of an RF bias (page 537, last sentence before figure 6). Oh teaches applying 10-15 W of RF bias power while applying 150-200 W of plasma excitation power.

It would have been obvious to one skilled in the art to control the DC bias taught by Kwon by using applying a high frequency power to the substrate because Kwon

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discloses using the apparatus used by Oh and Oh teaches controlling the DC bias with a high frequency power source. The application of a high frequency bias power would cause the chemical species to be supplied in a direction perpendicular to the thin film.

**Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon in view of Oh, as applied above to claims 28, in view of US Patent 4,613,401 issued to Hoshino and further in view of US Patent 6,913,706 issued to Yan et al. (hereinafter, Yan).**

The combination of Kwon and Oh does not teach adding an organic gas to the etchant.

Hoshino teaches adding ethanol vapor to a plasma etching gas when etching Cr. See, for example, abstract and column 4, lines 28+.

Yan teaches that chromium-oxychloride is produced when Cr is plasma etched with  $\text{Cl}_2$  and  $\text{O}_2$  (column 2, lines 22-24).

It would have been obvious to one skilled in the art to add ethanol to the etchant of Kwon because Hoshino teaches that the addition of ethanol greatly enhances the removal of chromium-oxy-chloride reaction products and Yan teaches that chromium-oxy-chloride would be produced by Kwon's use of  $\text{Cl}_2$  and  $\text{O}_2$  to plasma etch Cr.

**Claims 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon, as applied above to claim 32, in view of US Patent 4,613,401 issued to Hoshino and further in view of Yan.**

Kwon does not teach adding an organic gas to the etchant.

Hoshino teaches adding ethanol vapor to a plasma etching gas when etching Cr. See, for example, abstract and column 4, lines 28+.

Yan teaches that chromium-oxychloride is produced when Cr is plasma etched with  $\text{Cl}_2$  and  $\text{O}_2$  (column 2, lines 22-24).

It would have been obvious to one skilled in the art to add ethanol to the etchant of Kwon because Hoshino teaches that the addition of ethanol greatly enhances the removal of chromium-oxy-chloride reaction products and Yan teaches that chromium-oxy-chloride would be produced by Kwon's use of  $\text{Cl}_2$  and  $\text{O}_2$  to plasma etch Cr.

**Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon, as applied above to claim 40, in view of US Patent 6,989,603 issued to Zhang.**

Kwan does not teach a mask comprising an optical proximity correction pattern.

Zhang teaches masks comprising an optical proximity correction pattern.

It would have been obvious to one skilled in the art to fabricate a mask comprising an optical proximity correction pattern because Zhang teaches that such masks well known as being highly precise (column 2, line 33).

### ***Response to Arguments***

Applicant's arguments, see second paragraph of page 11, filed May 21, 2007, with respect to the rejection of claims 23-25 and 27-30 under 35 U.S.C. 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground of rejection is made in view of Oh's teaching that the DC bias of Kwon is controlled by the application of a high frequency bias power.

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Applicant's other arguments filed May 21, 2007 have been fully considered but they are not persuasive.

First, Applicant wishes to note that they have amended independent claims 21, 31, 39 and 43 in order to specify that the dry etching gas comprises C12 and O2.

Second, Applicant notes that the Examiner asserts that Kwon teaches etching a Cr photomask using an ICP, C12, O2 together with the use of an organic resist, a photoresist coverage, photoresist etch selectivity of less than 1.5, and parameters that match those used by

With respect to the limitation that requires using a power level below that which causes a jump in plasma density applicant argues the rejection is clearly based on a mere assumption and is not based on any direct teaching, suggestion or other evidence. Additionally, applicant argues: "there is no disclosure at all about any plasma density jump and any influence on power reduction. In the absence of any recognition of the influence of a plasma density jump on power reduction, it would not even be obvious to try to use conditions that might achieve that result."

The examiner notes it is well established that plasma source power and plasma density inextricably related. In fact, plasma source power is the single most important factor in determining plasma density with chamber pressure also being known to influence the plasma density. Applicant discloses using a plasma source power between about 140 W and 250 W and a chamber pressure of 9-16 mTorr (see figures 2a-6a and 2c-6c).

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In response to applicant's argument that Kwon fail to the use of and ICP, it is noted that this features upon which applicant relies (i.e., using an ICP) is not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Furthermore, the skilled artisan would recognize that Kwon is using an ICP because the parameters disclosed by Kwon, particularly plasma power and chamber pressure, could not sustain a plasma in a capacitively coupled plasma reactor.

With respect to claims 29 and 33-35, applicant argues Hoshino teaches adding ethanol vapor when using  $\text{CCl}_4$  and  $\text{O}_2$  to plasma etch Cr but Hoshino has no teaching or suggestion for adding ethanol the dry etching gas according to the present invention which comprises  $\text{Cl}_2$  and  $\text{O}_2$ .

The examiner notes that Hoshino teaches that it is beneficial to add ethanol when a chromium-oxychloride is produced. While Hoshino happens to generate the chromium-oxychloride be etching with  $\text{CCl}_4$  and  $\text{O}_2$ , the skilled artisan would immediately envisage the production of chromium-oxychloride from Kwon's use of  $\text{Cl}_2$  and  $\text{O}_2$  to etch Cr. As such, it would have been obvious to add the Hoshino ethanol to Kwon's etchant. In support of the examiner's position that the skilled artisan would recognize that Kwon's etching of Cr with  $\text{Cl}_2$  and  $\text{O}_2$  would generate chromium-oxychloride, the examiner has added the Yan reference to the rejection of claims 29 and 33-35.



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**Conclusion**

The additionally cited and applied art prior art (Oh and Yan) were applied only in 103 rejections. However, the examiner notes that these references are applicable to at least claim 1 in a 102 rejection. Such a rejection was not made at this time to avoid an undue multiplicity of rejections.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441.

The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink that reads "Allan Olsen". The signature is written in a cursive, flowing style.

Allan Olsen  
Primary Examiner  
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